



Grid'5000: A Production-grade Testbed for Experiment-driven Computer Science on HPC and Clouds

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A Production-grade Testbed for Experiment-driven Computer Science on HPC and Clouds

<http://www.grid5000.fr/>

Overall Goal

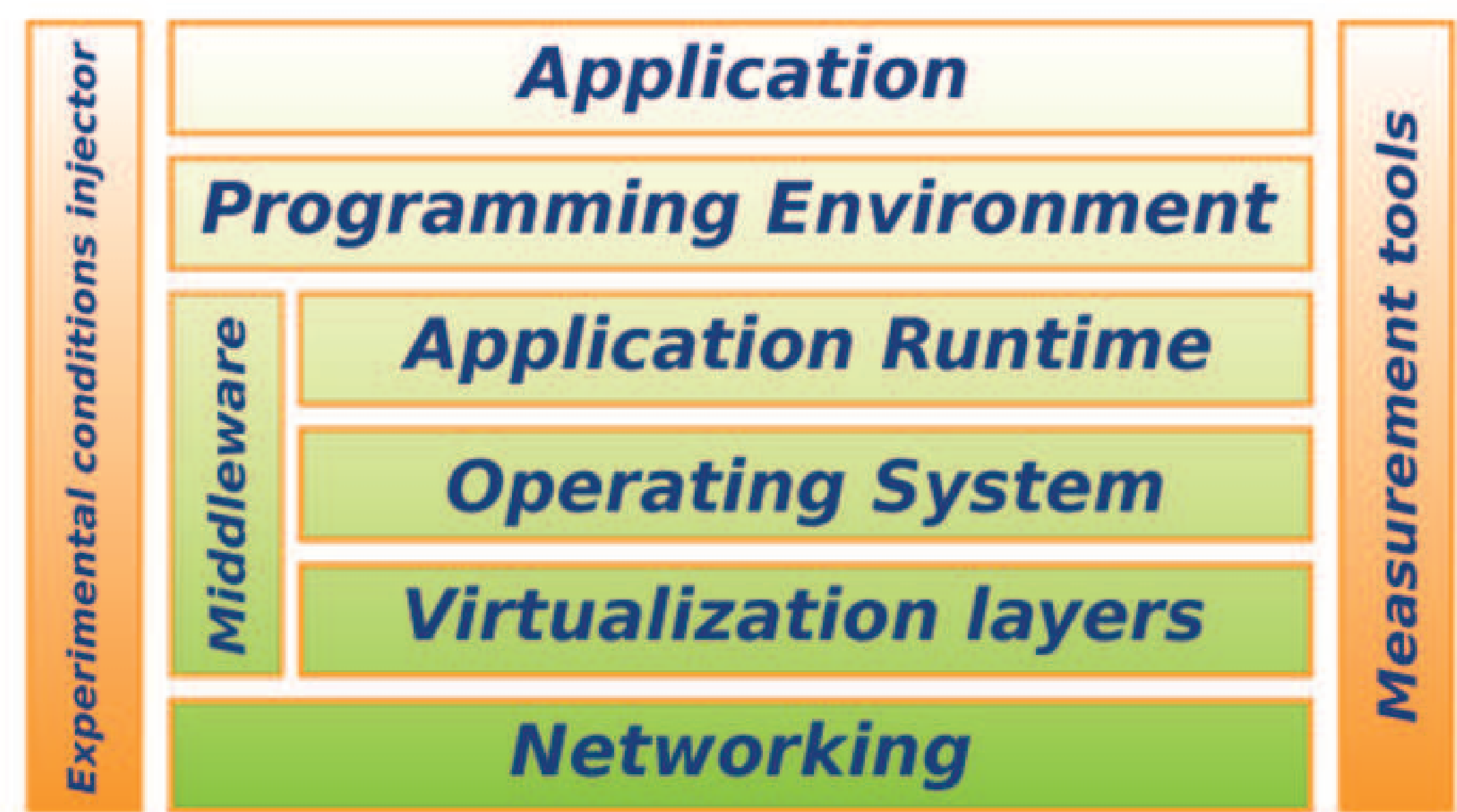
Design & provide a testbed that supports high-quality experimental science

- ▶ Large scale, complex experiments
- ▶ Trustworthy results
- ▶ Reproducible experiments

1200 nodes (8000 cores) in 10 sites
500+ users per year since 2006

Key features

- ▶ Experiment on all layers : fully reconfigurable



- ▶ **Software stack** (root on bare metal)
- ▶ **Network isolation** (intrusive security-sensitive protocols)
- ▶ **Experimental conditions** (fault injection)
- ▶ **Resources reservation** (nodes, network, storage)
- ▶ **REST API** for XP control tools (Expo, XPFlow, Execo)
- ▶ **Measurement and monitoring** infrastructure
- ▶ Support for **Big Data** and **Open Science**

- ▶ **Access high end hardware networks**
 - ▶ **High performance networks** : Infiniband, Myrinet
 - ▶ **Accelerators** (GPU, MIC)
 - ▶ **Dedicated 10 Gbps backbone** (RENATER)

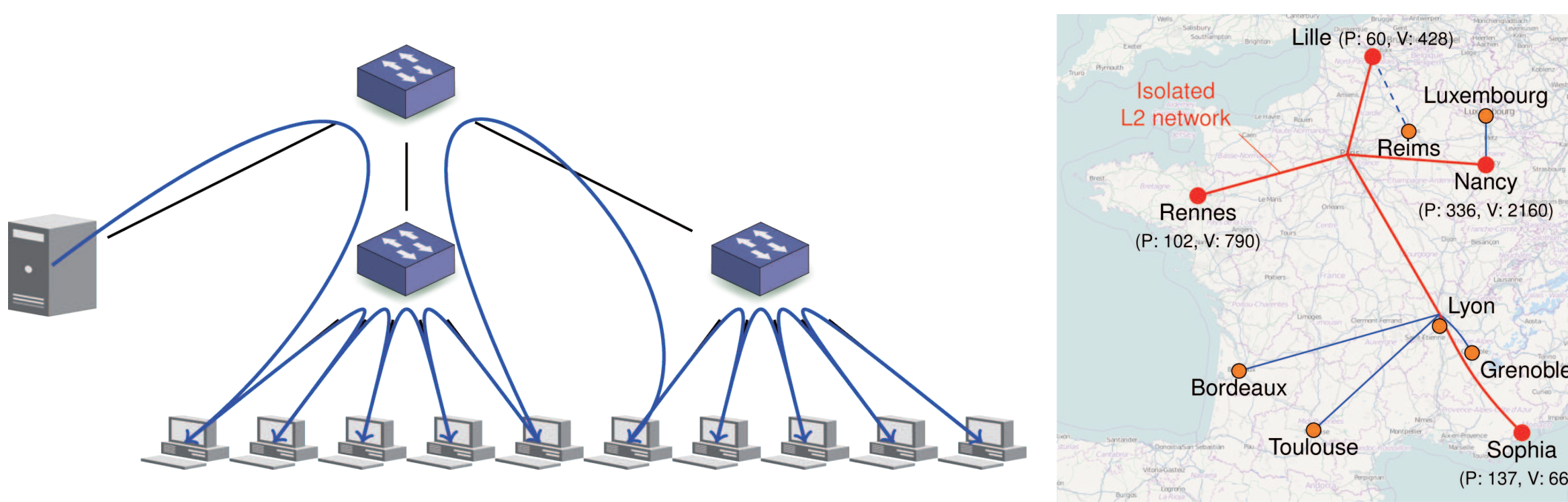
Ground-breaking experiments

- ▶ **Snooze Autonomic Cloud Management System**

Time	System services		Architecture		GL scalability	GM scalability	System scalability
	Grid manager	Grid manager	Grid manager	Grid manager	1 GL 5K GMs	1 GL - 1 GM 5K LCs	1 GL - 1K GMs 10K LCs
30 seconds					1485 GMs	509 LCs	-
1 minutes					3861 GMs	1043 LCs	979 GMs - 482 LCs
3 minutes					4686 GMs	2520 LCs	983 GMs - 1492 LCs
10 minutes					4688 GMs	2633 LCs	1000 GMs - 7436 LCs
15 minutes					4645 GMs	4283 LCs	1000 GMs - 9593 LCs
20 minutes					4629 GMs	4300 LCs	1000 GMs - 10000 LCs

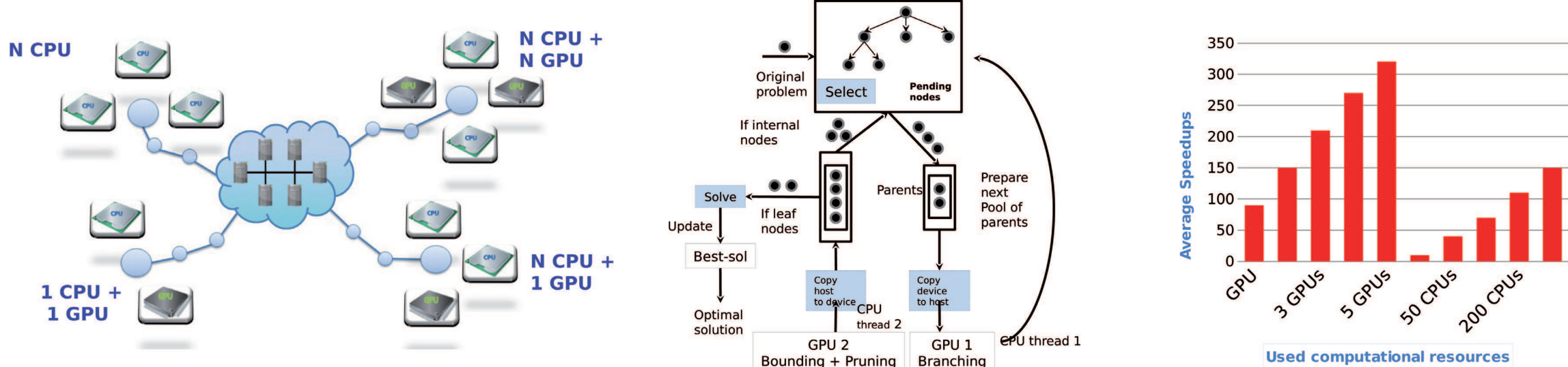
Scalability evaluation on 538 nodes / 5 sites

- ▶ **Testing of the Kadeploy3 provisioning system**



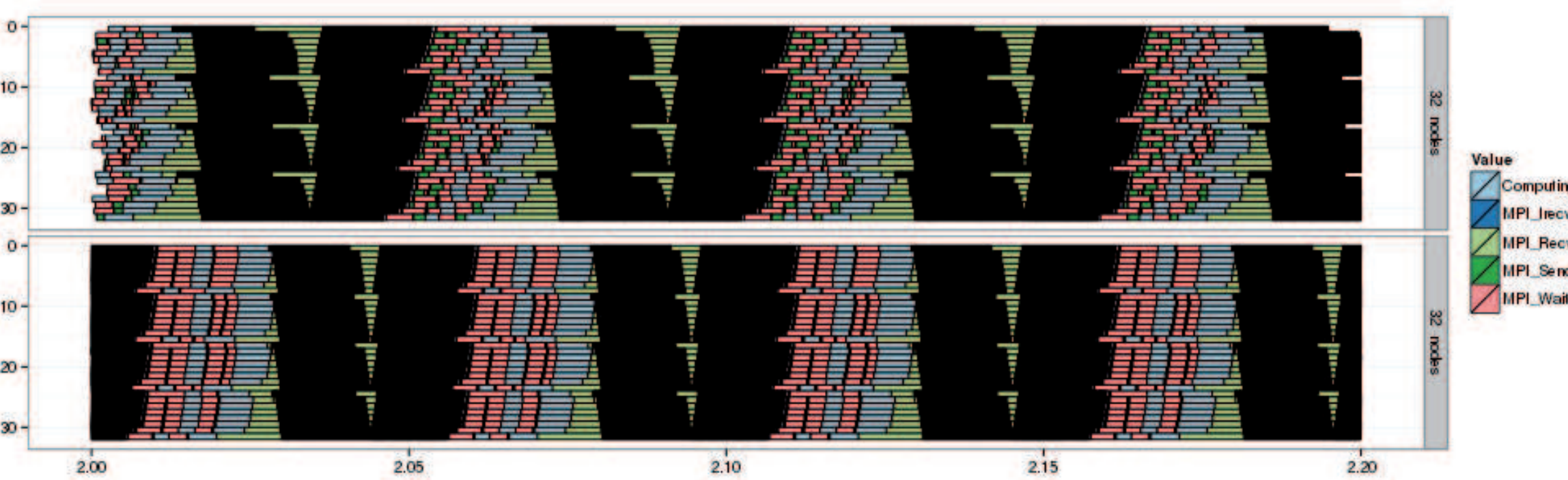
4000 virtual machines in a global VLAN

- ▶ **Solving combinatorial optimization problems**



Hybrid multi-core and GPU computing

- ▶ **Calibration of the SMPI simulator models**



Combining real and simulated executions

Get a free account

<http://www.grid5000.fr/open-access>

Software stack

- ▶ **Kadeploy** : <http://kadeploy3.gforge.inria.fr>
- ▶ **OAR** : <http://oar.imag.fr>
- ▶ **Distem** : <http://distem.gforge.inria.fr>
- ▶ **Expo** : <http://expo.imag.fr>
- ▶ **XPFlow** : <http://xpflow.gforge.inria.fr>
- ▶ **Execo** : <http://execo.gforge.inria.fr>



and several French universities